

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application.

Claims 1-46 are canceled without prejudice or disclaimer.

Claims 47-90 are new.

Listing of Claims:

47. (New) A process for upgrading an ore or concentrate that contains metal sulphur minerals and gangue material, the process including the stages of:

a) selectively leaching the ore or concentrate using an ammoniacal solution containing ammonium carbonate that forms soluble metal ammine complexes;

b) separating the solid and liquid phases formed in stage a) with the liquid phase forming a solution including soluble metal ammine complexes and the solid phase including at least in part the gangue material;

c) removing ammonia and carbon dioxide from the liquid phase formed in step b) under conditions that are selected to facilitate the precipitation of valuable metal(s) and minimise the sulphur content in the valuable metal(s) precipitated; and

d) separating the solid and liquid phases formed in stage c) with the solid phase forming a more-concentrated source of valuable metal.

48. (New) The process according to claim 47, wherein stage a) is carried out at a pH ranging from 7 to 10.5.

49. (New) The process according to claim 47, wherein stage a) is carried out at a temperature ranging from 60 to a temperature just below boiling point.

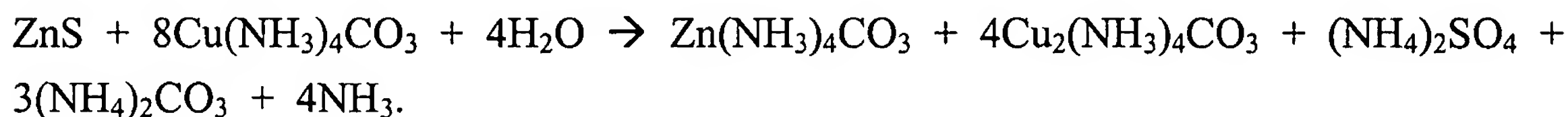
50. (New) The process according to claim 47, wherein the process includes adding to stage a) a metal oxidant that undergoes a reduction reaction to facilitate the dissolution of the metal sulphur compounds.

51. (New) The process according to claim 50, wherein the metal oxidant can be regenerated by oxidation.

52. (New) The process according to claim 50, wherein the metal oxidant is in the form of a cupric cation.

53. (New) The process according to claim 52, wherein the concentration of copper cations supplied to stage a) in the ammoniacal solution is at least 0.15 g/L.

54. (New) The process according to claim 52, whereby when the metal is zinc and the ore contains sphalerite (ZnS), leaching of sphalerite may be represented by the following reaction:



55. (New) The process according to claim 54, wherein the process includes maintaining the concentration of ammonia in stage a) at a level in accordance with the following formulae:

$$[\text{NH}_3] \geq ([\text{Zn}] + [\text{Cu}] \times 8) + ([\text{SO}_4] \times 2)$$

56. (New) The process according to claim 52, wherein cupric copper is regenerated by oxidation with oxygen according to the following reaction:



57. (New) The process according to claim 47, wherein an oxygen containing gas is supplied to stage a).

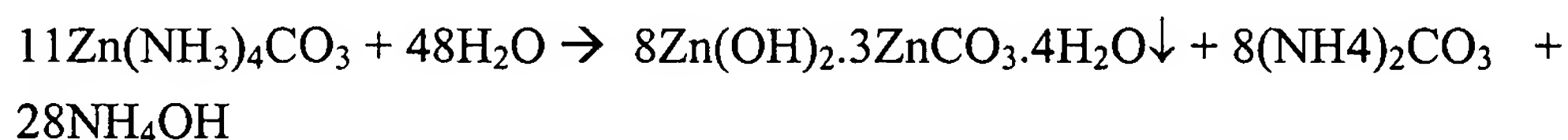
58. (New) The process according to claim 47, wherein an oxygen-rich gas is supplied to stage a).

59. (New) The process according to claim 47, wherein stage c) is carried out at a temperature ranging from 90°C to boiling point so as to evaporate ammonia and thereby facilitate the precipitation of metal compounds.

60. (New) The process according to claim 59, wherein stage c) includes sparging the liquid phase with steam so as to regulate temperature and provide a carrier gas for further ammonia removal.

61. (New) The process according to claim 47, wherein stage c) is carried out to an end pH of 6.8 or more to minimise the precipitation of metal sulphate minerals.

62. (New) The process according to claim 59, whereby when the metal is zinc the precipitation of zinc and the evaporation of ammonia occurring in stage c) can be represented by the following reaction:



63. (New) The process according to claim 47, further including a stage of calcining the solid phase recovered in stage d).

64. (New) The process according to claim 63, wherein the calcination stage is carried out by heating the solid phase formed in stage c) to a temperature ranging from 100°C to 500°C.

65. (New) The process according to claim 47, wherein the liquid phase recovered from stage d) is treated to precipitate sulphur and compounds containing sulphur from the liquid phase as a salt.

66. (New) The process according to claim 65, wherein a neutralising agent is added to the liquid phase of stage d).

67. (New) The process according to claim 66, wherein the neutralising agent maintains the pH above 7 during the sulphate precipitation stage to minimise the level of ammonia remaining as ammonium hydroxide.

68. The process according to claim 65, wherein ammonia is removed from the liquid phase recovered from stage d) by heating the liquid phase.

69. (New) A plant for upgrading an ore or concentrate that contains metal(s) sulphur minerals and gangue material, the plant including:

a first stage in which an ammoniacal solution containing ammonium carbonate can selectively leach metal(s) and metal compounds from the ore or concentrate to form soluble metal ammine complexes;

a separator for separating the solid and liquid phases formed, in which, the liquid phase includes soluble metal ammine complexes and the solid phase includes at least in part gangue material;

a second stage that is supplied with the liquid phase formed in the separator and from which ammonia and carbon dioxide are removed under conditions that are selected to facilitate the precipitation of valuable metal(s) and minimize the sulphur content in the valuable metal(s) precipitate; and

a further separator for separating the solid and liquid phases formed in the second stage whereby the solid phase forms a more-concentrate source of valuable metal(s) .

70. (New) The plant according to claim 69, wherein the pH in the first vessel ranges from 7 to 10.5.

71. (New) The plant according to claim 69, wherein the temperature in the first stage ranges from 60 to a temperature just below boiling temperature.

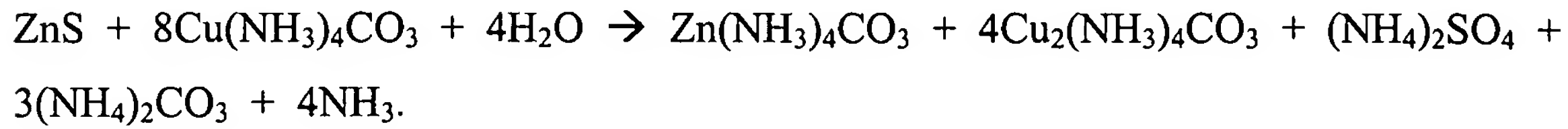
72. (New) The plant according to claim 69, wherein a metal oxidant is supplied to the first stage which undergoes a reduction reaction to facilitate the dissolution of the metal sulphur compounds.

73. (New) The plant according to claim 72, wherein the metal oxidant can be regenerated by oxidation.

74. (New) The plant according to claim 73, wherein the metal oxidant is in the form of a cupric cation.

75. (New) The plant according to claim 74, wherein the concentration of copper cations supplied to the first stage in the ammoniacal solution is at least 0.15 g/L.

76. (New) The plant according to claim 73, wherein the metal is zinc and the ore contains sphalerite (ZnS), leaching of sphalerite may be represented by the following reaction:



77. (New) The plant according to claim 76, wherein the concentration of ammonia in the first stage is maintained at a level in accordance with the following formulae:

$$[\text{NH}_3] \geq ([\text{Zn}] + [\text{Cu}] \times 8) + ([\text{SO}_4] \times 2)$$

78. (New) The plant according to claim 74, wherein the metal oxidant is cupric copper, reduced copper is regenerated by oxidation with oxygen according to the following reaction:



79. (New) The plant according to claim 75, wherein an oxygen containing gas is supplied to the first stage to regenerate the metal oxidant.

80. (New) The plant according to claim 79, wherein the oxygen containing gas is purified oxygen.

81. (New) The plant according to claim 69, wherein the second stage is carried out at a temperature ranging from 90° to boiling point so as to evaporate ammonia and thereby facilitate the precipitation of metal compounds.

82. (New) The plant according to claim 81, wherein steam is sparged through the liquid phase of the second stage to provide heat and a carrier gas for further ammonia removal.

83. (New) The plant according to claims 69, wherein the second stage is carried out to an end pH of 6.8 or more to avoid excessive amounts of metal sulphate forming.

84. (New) The plant according to claim 71, whereby when the metal is zinc the precipitation

of zinc and the evaporation of ammonia occurring in stage c) can be represented by a reaction of the form:



85. (New) The plant according to claim 69, further including a stage of calcining the solid phase recovered in the further separator.

86. (New) The plant according to claim 85, wherein the calcination stage is carried out by heating the solid phase formed in stage c) to a temperature of at least 100°C and preferably, above 300°C.

87. (New) The plant according to claim 69, wherein the liquid phase from the separator stage d) is treated to precipitate sulphur and compounds containing sulphur from the liquid phase as a salt.

88. (New) The plant according to claim 87, wherein the liquid phase from stage d) be treated by adding a neutralising agent to the liquid phase.

89. (New) The plant according to claim 88, wherein the neutralising agent maintains the pH above 7 during the sulphate precipitation stage to minimise the level of ammonia remaining as ammonium hydroxide.

90. (New) The plant according to claim 87, wherein ammonia is removed from the liquid phase in stage d) by heating the liquid phase and sparging with steam.